

UNITED STATES NAVAL OBSERVATORY
CIRCULAR NO. 18

U.S. Naval Observatory, Washington 25, D. C.

May 18, 1950

EPHEMERIS OF VESTA, 1950-51

With the cooperation of the British Nautical Almanac Office, and with the primary object of encouraging accurate observations of Ceres, Pallas, Juno, and Vesta, it is intended to publish precise ephemerides of these planets for the period during which they transit the meridian when the Sun is below the horizon, between latitudes 56° north and 34° south. Theoretical studies (see *Astronomical Journal*, 54, 10, 1948) have indicated that if these four planets are assiduously observed with transit circles the positions of the equinox and equator among the stars can be found with greater accuracy than by observations of any other objects. Photographic observations should be equally valuable for the equinox determination, although they are not suitable for direct determinations of fundamental declinations.

The ephemerides, supposed to be accurate to a few seconds of arc, serve a dual purpose. They serve for easy identification of the planet in the restricted field of view of a transit circle; and, equally for visual and photographic observations, the discordances between the ephemerides and the observations may be analyzed for the determination of differential corrections to the assumed star positions, and to various astronomical constants.

The rectangular equatorial heliocentric coordinates have been obtained by numerical step-by-step integration of their second derivatives with respect to

the time, at 20-day intervals. This work is a portion of a joint undertaking, sponsored by the Office of Naval Research, of the U. S. Naval Observatory, the Yale University Observatory, and the Watson Scientific Computing Laboratory. The actual integrations have been made at the Cincinnati Observatory, while the necessary differential corrections of the orbits have been made in the Office of the American Ephemeris. The results will be published in full in the *Astronomical Papers of the American Ephemeris*.

The geocentric ephemerides will appear in the *American Ephemeris* and in the *British Nautical Almanac* beginning with the volumes for 1952. Until then they will appear in this series of circulars. The ephemeris of Juno for the opposition of 1950 appeared in *Circular* No. 5, and ephemerides of Pallas and Ceres in *Circular* No. 7. The data in the present circular were calculated in the British Nautical Almanac Office.

The apparent ephemeris is immediately comparable with a meridian observation corrected for geocentric parallax. But it is to be specially noted that this ephemeris, in common with the ephemerides of the Sun, Moon, and other planets, is free from the effects of the short-period terms of the nutation, and hence is inconsistent with observed positions derived from clock corrections that are affected by short-period terms, or from nadirs. Meridian observers are cautioned that inattention to this point may result in important errors.

The astrometric ephemeris, obtained by applying the reduction in the column *Red. to Astrom. Place* to the apparent ephemeris, is referred to the mean equinox and equator 1950.0, and is affected by the elliptic term of the annual aberration. It is therefore immediately comparable with photographic positions obtained by comparing the planet with catalogue mean places of neighboring stars, it being only necessary to correct the observations for geocentric parallax.

Systematic observations of Ceres, Pallas, Juno, and Vesta will yield valuable information concerning the mass of the Moon, if they are obtained within two or three days of the time when the lunar inequality in right ascension is a maximum; the times of maxima are indicated by asterisks, principally as a guide to photographic observations. Meridian observers must observe the planets at nearly every opportunity, if a good equinox determination is to be obtained.

FOR 0^h UNIVERSAL TIME

FOR 0 ^h UNIVERSAL TIME										Transit, Meridian of Green- wich					
Date	Apparent Right Ascension				Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth	Hor. Paral- lax					
	h	m	s	s	s	°	'	"	"	"					
July 16*	2	38	37.10	+ 76.15	- 1.26	+ 8	15	40.4	+ 248.4	-0 14.4	2.559 346	-11122	3.44	h	m
17	2	39	53.25	75.51	1.27	8	19	48.8	242.6	0 14.5	2.548 224	11167	3.45	7	04.8
18	2	41	08.76	74.88	1.29	8	23	51.4	236.8	0 14.6	2.537 057	11211	3.47	6	59.4
19	2	42	23.64	74.21	1.32	8	27	48.2	230.8	0 14.8	2.525 846	11252	3.48	6	56.7
20	2	43	37.85	73.55	1.34	8	31	39.0	225.0	0 14.9	2.514 594	11293	3.50	6	54.0
21	2	44	51.40	+ 72.88	- 1.37	+ 8	35	24.0	+ 219.1	-0 15.1	2.503 301	-11331	3.52	6	51.3
22	2	46	04.28	72.18	1.40	8	39	03.1	213.1	0 15.3	2.491 970	11368	3.53	6	48.6
23	2	47	16.46	71.48	1.42	8	42	36.2	207.2	0 15.4	2.480 602	11404	3.55	6	45.9
24	2	48	27.94	70.77	1.45	8	46	03.4	201.2	0 15.6	2.469 198	11438	3.56	6	43.1
25	2	49	38.71	70.04	1.48	8	49	24.6	195.3	0 15.7	2.457 760	11471	3.58	6	40.3
26	2	50	48.75	+ 69.31	- 1.50	+ 8	52	39.9	+ 189.4	-0 15.8	2.446 289	-11502	3.60	6	37.6
27	2	51	58.06	68.55	1.53	8	55	49.3	183.3	0 16.0	2.434 787	11532	3.61	6	34.8
28	2	53	06.61	67.79	1.55	8	58	52.6	177.4	0 16.1	2.423 255	11561	3.63	6	32.0
29*	2	54	14.40	67.01	1.58	9	01	50.0	171.3	0 16.3	2.411 694	11589	3.65	6	29.2
30	2	55	21.41	66.22	1.60	9	04	41.3	165.3	0 16.4	2.400 105	11616	3.67	6	26.4
31	2	56	27.63	+ 65.42	- 1.63	+ 9	07	26.6	+ 159.3	-0 16.6	2.388 489	-11640	3.68	6	23.5
Aug. 1	2	57	33.05	64.59	1.66	9	10	05.9	153.1	0 16.8	2.376 849	11665	3.70	6	20.7
2	2	58	37.64	63.74	1.69	9	12	39.0	146.9	0 16.9	2.365 184	11687	3.72	6	17.8
3	2	59	41.38	62.89	1.71	9	15	05.9	140.9	0 16.9	2.353 497	11707	3.74	6	14.9
4	3	00	44.27	62.01	1.74	9	17	26.8	134.6	0 17.1	2.341 790	11727	3.76	6	12.0
5	3	01	46.28	+ 61.11	- 1.77	+ 9	19	41.4	+ 128.5	-0 17.2	2.330 063	-11744	3.78	6	09.1
6	3	02	47.39	60.20	1.79	9	21	49.9	122.2	0 17.4	2.318 319	11759	3.80	6	06.2
7	3	03	47.59	59.27	1.82	9	23	52.1	115.9	0 17.5	2.306 560	11773	3.82	6	03.3
8	3	04	46.86	58.32	1.85	9	25	48.0	109.7	0 17.6	2.294 787	11784	3.83	6	00.3
9	3	05	45.18	57.34	1.88	9	27	37.7	103.4	0 17.8	2.283 003	11794	3.85	5	57.3
10	3	06	42.52	+ 56.35	- 1.90	+ 9	29	21.1	+ 97.0	-0 17.9	2.271 209	-11801	3.87	5	54.3
11	3	07	38.87	55.35	1.92	9	30	58.1	90.8	0 18.0	2.259 408	11805	3.89	5	51.3
12	3	08	34.22	54.32	1.95	9	32	28.9	84.4	0 18.1	2.247 603	11808	3.92	5	48.3
13*	3	09	28.54	53.26	1.99	9	33	53.3	78.1	0 18.3	2.235 795	11808	3.94	5	45.3
14	3	10	21.80	52.20	2.01	9	35	11.4	71.7	0 18.4	2.223 987	11806	3.96	5	42.3
15	3	11	14.00	+ 51.11	- 2.04	+ 9	36	23.1	+ 65.4	-0 18.5	2.212 181	-11800	3.98	5	39.2
16	3	12	05.11	50.01	2.06	9	37	28.5	59.1	0 18.6	2.200 381	11792	4.00	5	36.1
17	3	12	55.12	48.88	2.09	9	38	27.6	52.8	0 18.8	2.188 589	11782	4.02	5	33.0
18	3	13	44.00	47.74	2.11	9	39	20.4	46.4	0 18.9	2.176 807	11769	4.04	5	29.9
19	3	14	31.74	46.59	2.14	9	40	06.8	40.1	0 19.0	2.165 038	11752	4.06	5	26.7
20	3	15	18.33	+ 45.41	- 2.18	+ 9	40	46.9	+ 33.9	-0 19.1	2.153 286	-11735	4.09	5	23.6
21	3	16	03.74	44.21	2.20	9	41	20.8	27.6	0 19.2	2.141 551	11714	4.11	5	20.4
22	3	16	47.95	43.00	2.23	9	41	48.4	21.4	0 19.3	2.129 837	11690	4.13	5	17.2
23	3	17	30.95	41.78	2.25	9	42	09.8	15.1	0 19.4	2.118 147	11665	4.15	5	13.9
24	3	18	12.73	40.53	2.28	9	42	24.9	8.9	0 19.5	2.106 482	11637	4.18	5	10.7
25	3	18	53.26	+ 39.26	- 2.31	+ 9	42	33.8	+ 2.7	-0 19.6	2.094 845	-11606	4.20	5	07.4
26*	3	19	32.52	37.97	2.34	9	42	36.5	3.5	0 19.8	2.083 239	11574	4.22	5	04.1
27	3	20	10.49	36.67	2.36	9	42	33.0	9.8	0 19.9	2.071 665	11538	4.25	5	00.8
28	3	20	47.16	35.35	2.39	9	42	23.2	15.9	0 20.0	2.060 127	11500	4.27	4	57.5
29	3	21	22.51	34.00	2.42	9	42	07.3	22.2	0 20.1	2.048 627	11460	4.30	4	54.2
30	3	21	56.51	+ 32.63	- 2.45	+ 9	41	45.1	+ 28.4	-0 20.2	2.037 167	-11416	4.32	4	50.8
31	3	22	29.14	+ 31.23	2.48	+ 9	41	16.7	+ 34.6	0 20.3	2.025 751	-11371	4.34	4	47.4
Sept. 1	3	23	00.37		- 2.50	+ 9	40	42.1		-0 20.4	2.014 380		4.37	4	44.0

*Lunar inequality is a maximum in Right Ascension.

Approximate magnitude = 7.8

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension				Red. to Astrom. Place	Apparent Declination				Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h	m	s	s	s	°	'	"	"	'	"		"	h m
Sept. 1	3	23	00.37		- 2.50	+	9	40	42.1	- 0 20.4	2.014 380		4.37	4 44.0
2	3	23	30.20	+ 29.83	2.53		9	40	01.4	0 20.6	2.003 059	-11321	4.39	4 40.5
3	3	23	58.59	28.39	2.56		9	39	14.4	0 20.6	1.991 790	11269	4.42	4 37.1
4	3	24	25.52	26.93	2.58		9	38	21.3	0 20.7	1.980 577	11213	4.44	4 33.6
5	3	24	50.98	25.46	2.61		9	37	22.0	0 20.8	1.969 422	11155	4.47	4 30.1
				23.96					65.3			11092		
6	3	25	14.94		- 2.64	+	9	36	16.7	- 0 20.9	1.958 330		4.49	4 26.5
7	3	25	37.37	+ 22.43	2.66		9	35	05.2	0 21.0	1.947 304	-11026	4.52	4 23.0
8	3	25	58.27	20.90	2.69		9	33	47.6	0 21.1	1.936 347	10957	4.54	4 19.4
9*	3	26	17.60	19.33	2.72		9	32	24.0	0 21.1	1.925 464	10883	4.57	4 15.8
10	3	26	35.35	17.75	2.74		9	30	54.5	0 21.3	1.914 658	10806	4.60	4 12.1
				16.15					95.5			10725		
11	3	26	51.50		- 2.77	+	9	29	19.0	- 0 21.4	1.903 933		4.62	4 08.4
12	3	27	06.03	+ 14.53	2.80		9	27	37.7	0 21.5	1.893 293	-10640	4.65	4 04.7
13	3	27	18.93	12.90	2.83		9	25	50.5	0 21.6	1.882 743	10550	4.67	4 01.0
14	3	27	30.17	11.24	2.85		9	23	57.6	0 21.6	1.872 286	10457	4.70	3 57.3
15	3	27	39.75	9.58	2.87		9	21	59.0	0 21.7	1.861 927	10359	4.73	3 53.5
				7.91					124.1			10257		
16	3	27	47.66		- 2.90	+	9	19	54.9	- 0 21.8	1.851 670		4.75	3 49.7
17	3	27	53.88	+ 6.22	2.93		9	17	45.2	0 21.8	1.841 519	-10151	4.78	3 45.9
18	3	27	58.40	4.52	2.95		9	15	30.2	0 22.0	1.831 478	10041	4.80	3 42.0
19	3	28	01.22	2.82	2.98		9	13	09.9	0 22.1	1.821 552	9926	4.83	3 38.1
20	3	28	02.32	+ 1.10	3.01		9	10	44.4	0 22.2	1.811 743	9809	4.86	3 34.2
				0.63					150.7			9687		
21	3	28	01.69		- 3.03	+	9	08	13.7	- 0 22.2	1.802 056		4.88	3 30.2
22*	3	27	59.34	- 2.35	3.06		9	05	38.0	0 22.3	1.792 494	- 9562	4.91	3 26.3
23	3	27	55.24	4.10	3.08		9	02	57.4	0 22.4	1.783 062	9432	4.94	3 22.3
24	3	27	49.41	5.83	3.12		9	00	12.0	0 22.5	1.773 764	9298	4.96	3 18.2
25	3	27	41.82	7.59	3.14		8	57	21.8	0 22.6	1.764 603	9161	4.99	3 14.2
				9.35					174.9			9020		
26	3	27	32.47		- 3.16	+	8	54	26.9	- 0 22.6	1.755 583		5.01	3 10.1
27	3	27	21.36	- 11.11	3.19		8	51	27.5	0 22.6	1.746 709	- 8874	5.04	3 06.0
28	3	27	08.49	12.87	3.21		8	48	23.8	0 22.8	1.737 985	8724	5.06	3 01.8
29	3	26	53.86	14.63	3.24		8	45	15.7	0 22.8	1.729 415	8570	5.09	2 57.6
30	3	26	37.45	16.41	3.26		8	42	03.4	0 22.9	1.721 003	8412	5.11	2 53.4
				18.16					196.2			8249		
Oct. 1	3	26	19.29		- 3.29	+	8	38	47.2	- 0 23.0	1.712 754		5.14	2 49.2
2	3	25	59.36	- 19.93	3.32		8	35	27.0	0 23.1	1.704 672	- 8082	5.16	2 44.9
3	3	25	37.67	21.69	3.34		8	32	03.1	0 23.1	1.696 762	7910	5.19	2 40.6
4	3	25	14.23	23.44	3.36		8	28	35.6	0 23.2	1.689 029	7733	5.21	2 36.3
5	3	24	49.04	25.19	3.38		8	25	04.7	0 23.2	1.681 478	7551	5.23	2 32.0
				26.91					214.1			7366		
6	3	24	22.13		- 3.41	+	8	21	30.6	- 0 23.3	1.674 112		5.26	2 27.6
7*	3	23	53.50	- 28.63	3.43		8	17	53.4	0 23.3	1.666 937	- 7175	5.28	2 23.2
8	3	23	23.17	30.33	3.46		8	14	13.5	0 23.4	1.659 957	6980	5.30	2 18.7
9	3	22	51.15	32.02	3.48		8	10	30.9	0 23.5	1.653 177	6780	5.32	2 14.3
10	3	22	17.47	33.68	3.50		8	06	45.9	0 23.5	1.646 602	6575	5.34	2 09.8
				35.31					227.1			6365		
11	3	21	42.16		- 3.52	+	8	02	58.8	- 0 23.5	1.640 237		5.37	2 05.3
12	3	21	05.24	- 36.92	3.54		7	59	09.8	0 23.6	1.634 087	- 6150	5.39	2 00.7
13	3	20	26.74	38.50	3.56		7	55	19.2	0 23.7	1.628 155	5932	5.40	1 56.1
14	3	19	46.71	40.03	3.59		7	51	27.2	0 23.7	1.622 446	5709	5.42	1 51.5
15	3	19	05.17	41.54	3.60		7	47	34.1	0 23.8	1.616 965	5481	5.44	1 46.9
				43.00					233.9			5250		
16	3	18	22.17		- 3.62	+	7	43	40.2	- 0 23.8	1.611 715		5.46	1 42.3
17	3	17	37.75	- 44.42	- 3.64	+	7	39	45.8	- 0 23.9	1.606 700	- 5015	5.48	1 37.6

*Lunar inequality is a maximum in Right Ascension.

Approximate magnitude = 7.3

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension	Red. to Astrom. Place	Apparent Declination	Red. to Astrom. Place	True Distance from Earth	Hor. Paral- lax	Transit, Meridian of Green- wich
	^h ^m ^s ^s	^s	[°] ['] ["] ["]	['] ["]		["]	^h ^m
Oct. 17	3 17 37.75 - 45.79	- 3.64	+ 7 39 45.8 - 234.7	- 0 23.9	1.606 700 - 4777	5.48	1 37.6
18	3 16 51.96 47.12	3.66	7 35 51.1 234.7	0 23.9	1.601 923 4535	5.49	1 32.9
19*	3 16 04.84 48.40	3.68	7 31 56.4 234.4	0 23.9	1.597 388 4291	5.51	1 28.2
20	3 15 16.44 49.63	3.70	7 28 02.0 233.8	0 24.0	1.593 097 4042	5.52	1 23.5
21	3 14 26.81 50.81	3.72	7 24 08.2 232.9	0 24.0	1.589 055 3792	5.54	1 18.7
22	3 13 36.00 - 51.94	- 3.74	+ 7 20 15.3 - 231.9	- 0 24.1	1.585 263 - 3537	5.55	1 13.9
23	3 12 44.06 53.02	3.76	7 16 23.4 230.4	0 24.1	1.581 726 3281	5.56	1 09.1
24	3 11 51.04 54.04	3.77	7 12 33.0 228.7	0 24.1	1.578 445 3022	5.58	1 04.3
25	3 10 57.00 54.99	3.79	7 08 44.3 226.7	0 24.2	1.575 423 2759	5.59	0 59.5
26	3 10 02.01 55.90	3.81	7 04 57.6 224.4	0 24.2	1.572 664 2495	5.60	0 54.7
27	3 09 06.11 - 56.74	- 3.82	+ 7 01 13.2 - 221.9	- 0 24.2	1.570 169 - 2228	5.60	0 49.8
28	3 08 09.37 57.52	3.84	6 57 31.3 218.9	0 24.2	1.567 941 1958	5.61	0 44.9
29	3 07 11.85 58.24	3.85	6 53 52.4 215.8	0 24.3	1.565 983 1687	5.62	0 40.0
30	3 06 13.61 58.89	3.86	6 50 16.6 212.3	0 24.3	1.564 296 1414	5.63	0 35.1
31	3 05 14.72 59.46	3.87	6 46 44.3 208.4	0 24.3	1.562 882 1138	5.63	0 30.2
Nov. 1	3 04 15.26 - 59.98	- 3.89	+ 6 43 15.9 - 204.3	- 0 24.3	1.561 744 - 861	5.63	0 25.3
2	3 03 15.28 60.43	3.91	6 39 51.6 199.9	0 24.4	1.560 883 582	5.64	0 20.4
3*	3 02 14.85 60.79	3.91	6 36 31.7 195.2	0 24.4	1.560 301 301	5.64	0 15.5
4	3 01 14.06 61.09	3.92	6 33 16.5 190.1	0 24.4	1.560 000 - 20	5.64	0 10.5
5	3 00 12.97 61.31	3.93	6 30 06.4 184.4	0 24.4	1.559 980 + 263	5.64	0 05.6
6	2 59 11.66 - 61.46	- 3.95	+ 6 27 01.6 - 179.2	- 0 24.4	1.560 243 + 546	5.64	23 00.6
7	2 58 10.20 61.53	3.96	6 24 02.4 173.1	0 24.3	1.560 789 831	5.64	23 50.7
8	2 57 08.67 61.53	3.97	6 21 09.3 166.9	0 24.4	1.561 620 1115	5.64	23 45.8
9	2 56 07.14 61.44	3.97	6 18 22.4 160.3	0 24.4	1.562 735 1400	5.63	23 40.8
10	2 55 05.70 61.27	3.98	6 15 42.1 153.4	0 24.4	1.564 135 1685	5.63	23 35.9
11	2 54 04.43 - 61.04	- 4.00	+ 6 13 08.7 - 146.4	- 0 24.4	1.565 820 + 1968	5.62	23 30.9
12	2 53 03.39 60.71	4.00	6 10 42.3 138.9	0 24.4	1.567 788 2251	5.61	23 26.0
13	2 52 02.68 60.32	4.01	6 08 23.4 131.3	0 24.4	1.570 039 2532	5.61	23 21.1
14	2 51 02.36 59.86	4.02	6 06 12.1 123.5	0 24.4	1.572 571 2812	5.60	23 16.1
15*	2 50 02.50 59.31	4.02	6 04 08.6 115.4	0 24.4	1.575 383 3090	5.59	23 11.2
16	2 49 03.19 - 58.71	- 4.03	+ 6 02 13.2 - 107.3	- 0 24.4	1.578 473 + 3366	5.57	23 06.3
17	2 48 04.48 58.03	4.03	6 00 25.9 98.8	0 24.3	1.581 839 3640	5.56	23 01.4
18	2 47 06.45 57.30	4.04	5 58 47.1 90.2	0 24.2	1.585 479 3912	5.55	22 56.6
19	2 46 09.15 56.49	4.03	5 57 16.9 81.5	0 24.3	1.589 391 4181	5.54	22 51.7
20	2 45 12.66 55.63	4.04	5 55 55.4 72.7	0 24.3	1.593 572 4448	5.52	22 46.8
21	2 44 17.03 - 54.72	- 4.05	+ 5 54 42.7 - 63.7	- 0 24.2	1.598 020 + 4712	5.51	22 42.0
22	2 43 22.31 53.74	4.05	5 53 39.0 54.6	0 24.2	1.602 732 4973	5.49	22 37.2
23	2 42 28.57 52.72	4.05	5 52 44.4 45.4	0 24.2	1.607 705 5232	5.47	22 32.4
24	2 41 35.85 51.63	4.05	5 51 59.0 36.2	0 24.2	1.612 937 5487	5.46	22 27.6
25	2 40 44.22 50.51	4.05	5 51 22.8 26.8	0 24.1	1.618 424 5741	5.44	22 22.8
26	2 39 53.71 - 49.33	- 4.05	+ 5 50 56.0 - 17.3	- 0 24.1	1.624 165 + 5990	5.42	22 18.1
27	2 39 04.38 48.10	4.05	5 50 38.7 - 8.0	0 24.1	1.630 155 6237	5.40	22 13.3
28	2 38 16.28 46.84	4.05	5 50 30.7 + 1.6	0 24.0	1.636 392 6480	5.38	22 08.6
29*	2 37 29.44 45.54	4.06	5 50 32.3 11.2	0 24.0	1.642 872 6721	5.36	22 03.9
30	2 36 43.90 44.19	4.05	5 50 43.5 20.8	0 24.0	1.649 593 6957	5.33	21 59.3
Dec. 1	2 35 59.71 - 42.80	- 4.05	+ 5 51 04.3 + 30.5	- 0 24.0	1.656 550 + 7191	5.31	21 54.6
2	2 35 16.91	- 4.05	+ 5 51 34.8	- 0 24.0	1.663 741	5.29	21 50.0

*Lunar inequality is a maximum in Right Ascension.

Approximate magnitude = 7.1

FOR 0^h UNIVERSAL TIME

FOR 0 ^h UNIVERSAL TIME														Transit, Meridian of Green- wich
Date	Apparent Right Ascension				Red. to Astrom. Place	Apparent Declination				Red. to Astrom. Place	True Distance from Earth	Hor. Paral- lax		
	h	m	s	s	s	°	'	"	"	'	"	"	h	m
Dec.	2	2 35	16.91	- 41.39	- 4.05	+	5 51	34.8	+ 40.1	-0 24.0	1.663 741	+ 7420	5.29	21 50.0
	3	2 34	35.52	39.93	4.05		5 52	14.9	49.7	0 24.0	1.671 161	7646	5.27	21 45.4
	4	2 33	55.59	38.45	4.05		5 53	04.6	59.4	0 23.9	1.678 807	7869	5.24	21 40.8
	5	2 33	17.14	36.93	4.05		5 54	04.0	69.0	0 23.9	1.686 676	8087	5.22	21 36.3
	6	2 32	40.21	35.39	4.04		5 55	13.0	78.7	0 23.8	1.694 763	8302	5.19	21 31.8
	7	2 32	04.82	- 33.81	- 4.03	+	5 56	31.7	+ 88.4	-0 23.8	1.703 065	+ 8512	5.17	21 27.3
	8	2 31	31.01	32.21	4.03		5 58	00.1	97.9	0 23.8	1.711 577	8718	5.14	21 22.8
	9	2 30	58.80	30.59	4.03		5 59	38.0	107.5	0 23.7	1.720 295	8920	5.12	21 18.4
	10	2 30	28.21	28.95	4.03		6 01	25.5	116.9	0 23.7	1.729 215	9116	5.09	21 14.0
	11	2 29	59.26	27.30	4.03		6 03	22.4	126.3	0 23.7	1.738 331	9308	5.06	21 09.6
	12*	2 29	31.96	- 25.63	- 4.02	+	6 05	28.7	+ 135.7	-0 23.6	1.747 639	+ 9495	5.04	21 05.2
	13	2 29	06.33	23.94	4.01		6 07	44.4	144.8	0 23.6	1.757 134	9678	5.01	21 00.9
	14	2 28	42.39	22.25	4.01		6 10	09.2	154.0	0 23.5	1.766 812	9854	4.98	20 56.6
	15	2 28	20.14	20.56	4.01		6 12	43.2	162.9	0 23.5	1.776 666	10027	4.95	20 52.3
	16	2 27	59.58	18.85	4.00		6 15	26.1	171.7	0 23.5	1.786 693	10195	4.93	20 48.0
	17	2 27	40.73	- 17.16	- 4.00	+	6 18	17.8	+ 180.5	-0 23.4	1.796 888	+ 10358	4.90	20 43.8
	18	2 27	23.57	15.46	3.99		6 21	18.3	189.0	0 23.4	1.807 246	10516	4.87	20 39.6
	19	2 27	08.11	13.75	3.99		6 24	27.3	197.5	0 23.3	1.817 762	10670	4.84	20 35.5
	20	2 26	54.36	12.06	3.99		6 27	44.8	205.7	0 23.4	1.828 432	10819	4.81	20 31.3
	21	2 26	42.30	10.37	3.98		6 31	10.5	214.0	0 23.3	1.839 251	10965	4.78	20 27.2
	22	2 26	31.93	- 8.69	- 3.98	+	6 34	44.5	+ 221.9	-0 23.3	1.850 216	+ 11106	4.76	20 23.1
	23	2 26	23.24	7.00	3.96		6 38	26.4	229.8	0 23.2	1.861 322	11242	4.73	20 19.1
	24	2 26	16.24	5.33	3.96		6 42	16.2	237.5	0 23.2	1.872 564	11374	4.70	20 15.1
	25	2 26	10.91	3.66	3.95		6 46	13.7	245.1	0 23.2	1.883 938	11503	4.67	20 11.1
	26	2 26	07.25	2.01	3.95		6 50	18.8	252.5	0 23.1	1.895 441	11627	4.64	20 07.1
	27*	2 26	05.24	- 0.37	- 3.95	+	6 54	31.3	+ 259.8	-0 23.1	1.907 068	+ 11748	4.61	20 03.2
	28	2 26	04.87	+ 1.27	3.93		6 58	51.1	266.9	0 23.1	1.918 816	11864	4.59	19 59.3
	29	2 26	06.14	2.90	3.93		7 03	18.0	274.0	0 23.0	1.930 680	11976	4.56	19 55.4
	30	2 26	09.04	4.51	3.92		7 07	52.0	280.8	0 23.0	1.942 656	12085	4.53	19 51.5
	31	2 26	13.55	6.12	3.92		7 12	32.8	287.6	0 22.9	1.954 741	12190	4.50	19 47.7
Jan.	1	2 26	19.67	+ 7.71	- 3.91	+	7 17	20.4	+ 294.2	-0 22.9	1.966 931	+ 12292	4.47	19 43.9
	2	2 26	27.38	9.29	3.91		7 22	14.6	300.6	0 22.9	1.979 223	12388	4.45	19 40.1
	3	2 26	36.67	10.87	3.90		7 27	15.2	306.9	0 22.8	1.991 611	12482	4.42	19 36.3
	4	2 26	47.54	12.42	3.90		7 32	22.1	313.2	0 22.7	2.004 093	12571	4.39	19 32.6
	5	2 26	59.96	13.97	3.89		7 37	35.3	319.2	0 22.7	2.016 664	12656	4.36	19 28.9
	6	2 27	13.93	+ 15.51	- 3.88	+	7 42	54.5	+ 325.1	-0 22.7	2.029 320	+ 12738	4.34	19 25.2
	7	2 27	29.44	17.02	3.88		7 48	19.6	330.9	0 22.7	2.042 058	12815	4.31	19 21.5
	8*	2 27	46.46	18.53	3.87		7 53	50.5	336.5	0 22.7	2.054 873	12887	4.28	19 17.9
	9	2 28	04.99	20.02	3.86		7 59	27.0	342.0	0 22.6	2.067 760	12957	4.26	19 14.3
	10	2 28	25.01	21.49	3.85		8 05	09.0	347.2	0 22.6	2.080 717	13021	4.23	19 10.7
	11	2 28	46.50	+ 22.95	- 3.84	+	8 10	56.2	+ 352.4	-0 22.6	2.093 738	+ 13081	4.20	19 07.2
	12	2 29	09.45	24.39	3.84		8 16	48.6	357.3	0 22.6	2.106 819	13139	4.18	19 03.6
	13	2 29	33.84	25.80	3.83		8 22	45.9	362.2	0 22.5	2.119 958	13192	4.15	19 00.1
	14	2 29	59.64	27.20	3.82		8 28	48.1	366.8	0 22.5	2.133 150	13241	4.13	18 56.6
	15	2 30	26.84	28.58	3.82		8 34	54.9	371.2	0 22.5	2.146 391	13287	4.10	18 53.2
	16	2 30	55.42	+ 29.94	- 3.81	+	8 41	06.1	+ 375.6	-0 22.4	2.159 678	+ 13330	4.07	18 49.7
	17	2 31	25.36		- 3.81	+	8 47	21.7		-0 22.4	2.173 008		4.05	18 46.3

*Lunar inequality is a maximum in Right Ascension.

Approximate magnitude = 7.4

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension	Red. to Astrom. Place	Apparent Declination	Red. to Astrom. Place	True Distance from Earth	Hor. Paral- lax	Transit, Meridian of Green- wich
	h m s s	s	° ' " "	' "		"	h m
Jan. 17	2 31 25.36 + 31.28	- 3.81	+ 8 47 21.7 + 379.8	-0 22.4	2.173 008 +13370	4.05	18 46.3
18	2 31 56.64 32.60	3.80	8 53 41.5 383.9	0 22.3	2.186 378 13406	4.02	18 42.9
19	2 32 29.24 33.90	3.79	9 00 05.4 387.7	0 22.3	2.199 784 13439	4.00	18 39.5
20	2 33 03.14 35.19	3.78	9 06 33.1 391.5	0 22.2	2.213 223 13469	3.98	18 36.2
21	2 33 38.33 36.46	3.78	9 13 04.6 395.1	0 22.2	2.226 692 13497	3.95	18 32.9
22	2 34 14.79 + 37.70	- 3.78	+ 9 19 39.7 + 398.6	-0 22.2	2.240 189 +13521	3.93	18 29.6
23*	2 34 52.49 38.93	3.77	9 26 18.3 401.9	0 22.2	2.253 710 13543	3.90	18 26.3
24	2 35 31.42 40.15	3.76	9 33 00.2 405.1	0 22.1	2.267 253 13562	3.88	18 23.0
25	2 36 11.57 41.34	3.76	9 39 45.3 408.2	0 22.1	2.280 815 13579	3.86	18 19.7
26	2 36 52.91 42.52	3.75	9 46 33.5 411.2	0 22.0	2.294 394 13593	3.84	18 16.5
27	2 37 35.43 + 43.68	- 3.74	+ 9 53 24.7 + 414.1	-0 22.0	2.307 987 +13605	3.81	18 13.3
28	2 38 19.11 44.84	3.73	10 00 18.8 416.7	0 22.0	2.321 592 13614	3.79	18 10.1
29	2 39 03.95 45.97	3.73	10 07 15.5 419.4	0 21.9	2.335 206 13621	3.77	18 06.9
30	2 39 49.92 47.09	3.72	10 14 14.9 421.9	0 21.9	2.348 827 13624	3.75	18 03.8
31	2 40 37.01 48.19	3.72	10 21 16.8 424.3	0 21.8	2.362 451 13626	3.72	18 00.6
Feb. 1	2 41 25.20 + 49.29	- 3.71	+10 28 21.1 + 426.6	-0 21.8	2.376 077 +13625	3.70	17 57.5
2	2 42 14.49 50.37	3.70	10 35 27.7 428.8	0 21.8	2.389 702 13621	3.68	17 54.4
3	2 43 04.86 51.44	3.69	10 42 36.5 430.9	0 21.7	2.403 323 13614	3.66	17 51.3
4	2 43 56.30 52.49	3.69	10 49 47.4 432.8	0 21.7	2.416 937 13605	3.64	17 48.3
5*	2 44 48.79 53.52	3.69	10 57 00.2 434.7	0 21.7	2.430 542 13592	3.62	17 45.2
6	2 45 42.31 + 54.55	- 3.68	+11 04 14.9 + 436.3	-0 21.7	2.444 134 +13578	3.60	17 42.2
7	2 46 36.86 55.55	3.68	11 11 31.2 437.9	0 21.6	2.457 712 13559	3.58	17 39.2
8	2 47 32.41 56.55	3.67	11 18 49.1 439.5	0 21.5	2.471 271 13539	3.56	17 36.2
9	2 48 28.96 57.52	3.66	11 26 08.6 440.8	0 21.5	2.484 810 13516	3.54	17 33.2
10	2 49 26.48 58.49	3.65	11 33 29.4 442.0	0 21.5	2.498 326 13490	3.52	17 30.2
11	2 50 24.97 + 59.44	- 3.65	+11 40 51.4 + 443.1	-0 21.5	2.511 816 +13463	3.50	17 27.3
12	2 51 24.41 60.36	3.65	11 48 14.5 444.1	0 21.4	2.525 279 13433	3.48	17 24.3
13	2 52 24.77 61.28	3.64	11 55 38.6 445.0	0 21.3	2.538 712 13400	3.47	17 21.4
14	2 53 26.05 62.18	3.64	12 03 03.6 445.9	0 21.3	2.552 112 13367	3.45	17 18.5
15	2 54 28.23 63.06	3.63	12 10 29.5 446.4	0 21.3	2.565 479 13330	3.43	17 15.6
16	2 55 31.29 + 63.94	- 3.62	+12 17 55.9 + 447.0	-0 21.2	2.578 809 +13292	3.41	17 12.7
17	2 56 35.23 64.84	- 3.61	+12 25 22.9 447.0	-0 21.1	2.592 101 13262	3.39	17 09.9
Approximate magnitude = 7.9							
Nov. 7	10 17 04.14 + 80.84	- 5.99	+13 45 18.4 - 295.7	+0 30.4	2.573 449 -13344	3.42	7 14.7
8	10 18 24.98 80.24	6.01	13 40 22.7 292.2	0 30.7	2.560 105 13385	3.44	7 12.1
9	10 19 45.22 79.63	6.03	13 35 30.5 288.7	0 30.9	2.546 720 13426	3.46	7 09.5
10	10 21 04.85 + 79.02	- 6.05	+13 30 41.8 - 285.1	+0 31.2	2.533 294 -13465	3.47	7 06.9
11	10 22 23.87 78.40	6.07	13 25 56.7 281.2	0 31.6	2.519 829 13502	3.49	7 04.3
12	10 23 42.27 77.76	6.09	13 21 15.5 277.3	0 31.8	2.506 327 13538	3.51	7 01.7
13	10 25 00.03 77.12	6.11	13 16 38.2 273.3	0 32.1	2.492 789 13574	3.53	6 59.0
14	10 26 17.15 76.47	6.13	13 12 04.9 269.0	0 32.5	2.479 215 13607	3.55	6 56.4
15*	10 27 33.62 + 75.80	- 6.15	+13 07 35.9 - 264.7	+0 32.8	2.465 608 -13638	3.57	6 53.7
16	10 28 49.42 75.12	- 6.17	+13 03 11.2 264.7	+0 33.0	2.451 970 13668	3.59	6 51.0

*Lunar inequality is a maximum in Right Ascension.

Approximate magnitude = 8.0

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension	Red. to Astrom. Place	Apparent Declination	Red. to Astrom. Place	True Distance from Earth	Hor. Paral- lax	Transit, Meridian of Green- wich
	^h ^m ^s ^s	^s	[°] ['] ["] ["]	['] ["]		["]	^h ^m
Nov. 16	10 28 49.42 + 75.13	- 6.17	+13 03 11.2 - 260.3	+0 33.0	2.451 970	-13669	3.59 6 51.0
17	10 30 04.55 74.44	6.19	12 58 50.9 255.6	0 33.4	2.438 301	13698	3.61 6 48.3
18	10 31 18.99 73.74	6.21	12 54 35.3 250.8	0 33.7	2.424 603	13726	3.63 6 45.6
19	10 32 32.73 73.03	6.23	12 50 24.5 245.9	0 34.0	2.410 877	13751	3.65 6 42.9
20	10 33 45.76 72.30	6.25	12 46 18.6 240.8	0 34.3	2.397 126	13775	3.67 6 40.2
21	10 34 58.06 + 71.57	- 6.27	+12 42 17.8 - 235.6	+0 34.6	2.383 351	-13797	3.69 6 37.5
22	10 36 09.63 70.81	6.30	12 38 22.2 230.1	0 34.9	2.369 554	13817	3.71 6 34.7
23	10 37 20.44 70.04	6.32	12 34 32.1 224.6	0 35.1	2.355 737	13836	3.74 6 31.9
24	10 38 30.48 69.25	6.34	12 30 47.5 218.9	0 35.4	2.341 901	13852	3.76 6 29.2
25	10 39 39.73 68.46	6.36	12 27 08.6 213.0	0 35.7	2.328 049	13867	3.78 6 26.4
26	10 40 48.19 + 67.64	- 6.39	+12 23 35.6 - 206.9	+0 36.0	2.314 182	-13878	3.80 6 23.6
27	10 41 55.83 66.81	6.41	12 20 08.7 200.7	0 36.3	2.300 304	13887	3.83 6 20.8
28	10 43 02.64 65.97	6.43	12 16 48.0 194.3	0 36.6	2.286 417	13895	3.85 6 18.0
29*	10 44 08.61 65.11	6.46	12 13 33.7 187.8	0 36.9	2.272 522	13898	3.87 6 15.1
30	10 45 13.72 64.22	6.49	12 10 25.9 181.0	0 37.2	2.258 624	13900	3.90 6 12.2
Dec. 1	10 46 17.94 + 63.33	- 6.50	+12 07 24.9 - 174.2	+0 37.5	2.244 724	-13900	3.92 6 09.4
2	10 47 21.27 62.43	6.52	12 04 30.7 167.2	0 37.7	2.230 824	13896	3.94 6 06.5
3	10 48 23.70 61.51	6.55	12 01 43.5 160.1	0 38.0	2.216 928	13889	3.97 6 03.6
4	10 49 25.21 60.57	6.58	11 59 03.4 152.7	0 38.4	2.203 039	13880	3.99 6 00.7
5	10 50 25.78 59.62	6.60	11 56 30.7 145.3	0 38.6	2.189 159	13869	4.02 5 57.8
6	10 51 25.40 + 58.66	- 6.62	+11 54 05.4 - 137.8	+0 38.9	2.175 290	-13855	4.05 5 54.8
7	10 52 24.06 57.69	6.65	11 51 47.6 130.1	0 39.2	2.161 435	13839	4.07 5 51.8
8	10 53 21.75 56.69	6.68	11 49 37.5 122.2	0 39.5	2.147 596	13821	4.10 5 48.9
9	10 54 18.44 55.67	6.71	11 47 35.3 114.1	0 39.8	2.133 775	13800	4.12 5 45.9
10	10 55 14.11 54.65	6.73	11 45 41.2 106.0	0 40.1	2.119 975	13777	4.15 5 42.9
11	10 56 08.76 + 53.61	- 6.75	+11 43 55.2 - 97.6	+0 40.4	2.106 198	-13751	4.18 5 39.8
12	10 57 02.37 52.55	6.78	11 42 17.6 89.2	0 40.6	2.092 447	13724	4.21 5 36.8
13*	10 57 54.92 51.47	6.81	11 40 48.4 80.5	0 40.9	2.078 723	13693	4.23 5 33.7
14	10 58 46.39 50.37	6.84	11 39 27.9 71.7	0 41.2	2.065 030	13660	4.26 5 30.6
15	10 59 36.76 49.25	6.87	11 38 16.2 62.7	0 41.5	2.051 370	13625	4.29 5 27.5
16	11 00 26.01 + 48.11	- 6.90	+11 37 13.5 - 53.6	+0 41.7	2.037 745	-13587	4.32 5 24.4
17	11 01 14.12 46.95	6.93	11 36 19.9 44.2	0 42.0	2.024 158	13547	4.35 5 21.3
18	11 02 01.07 45.77	6.95	11 35 35.7 34.8	0 42.2	2.010 611	13502	4.38 5 18.1
19	11 02 46.84 44.57	6.98	11 35 00.9 25.1	0 42.5	1.997 109	13457	4.41 5 14.9
20	11 03 31.41 43.35	7.01	11 34 35.8 15.3	0 42.8	1.983 652	13407	4.44 5 11.7
21	11 04 14.76 + 42.10	- 7.04	+11 34 20.5 - 5.3	+0 43.0	1.970 245	-13355	4.47 5 08.5
22	11 04 56.86 40.83	7.07	11 34 15.2 + 4.9	0 43.3	1.956 890	13299	4.50 5 05.3
23	11 05 37.69 39.54	7.09	11 34 20.1 15.1	0 43.5	1.943 591	13240	4.53 5 02.0
24	11 06 17.23 38.23	7.12	11 34 35.2 25.7	0 43.9	1.930 351	13178	4.56 4 58.7
25	11 06 55.46 36.88	7.16	11 35 00.9 36.3	0 44.1	1.917 173	13112	4.59 4 55.4
26	11 07 32.34 + 35.53	- 7.18	+11 35 37.2 + 47.0	+0 44.3	1.904 061	-13042	4.62 4 52.1
27*	11 08 07.87 34.15	7.21	11 36 24.2 57.9	0 44.6	1.891 019	12969	4.65 4 48.8
28	11 08 42.02 32.74	7.24	11 37 22.1 69.0	0 44.8	1.878 050	12891	4.69 4 45.4
29	11 09 14.76 31.32	7.27	11 38 31.1 80.1	0 45.1	1.865 159	12810	4.72 4 42.0
30	11 09 46.08 29.88	7.30	11 39 51.2 91.3	0 45.3	1.852 349	12724	4.75 4 38.6
31	11 10 15.96 + 28.42	- 7.33	+11 41 22.5 + 102.6	+0 45.5	1.839 625	-12636	4.78 4 35.2
32	11 10 44.38 27.00	- 7.36	+11 43 05.1 113.7	+0 45.8	1.826 989	12549	4.82 4 31.7

*Lunar inequality is a maximum in Right Ascension.

Approximate magnitude = 7.6